Aspects of Offshore Production of Fish Products for Stocks of the Grand Banks and Labrador Shelf

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ASPECTS OF OFFSHORE PRODUCTION OF FISH PRODUCTS FOR STOCKS OF THE GRAND BANKS AND LABRADOR SHELF

by

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ABSTRACT

Kulka, D. W. 1986. Aspects of offshore production of fish products for stocks of the Grand Banks and Labrador shelf. Can. Tech. Rep. Fish. Aquat. Sci. 1481: v + 46 p.

Twelve national fleets including Canada produce a variety of fresh, frozen and salted products, as well as oil and meal from about 260,000 t of offshore Grand Bank and Labrador Shelf catches. Canadian wetfish trawlers with minimum processing capability landed whole or gutted fish. On the other hand, foreign factory vessels were observed to produce 77 products ranging from gutted fish to boneless trimmed fillets and post-processed by-products. Each type was frozen into a variety of sizes of cellophane interleafed or solid blocks, frozen separately, placed into bulk bags (shrimp), canned or converted into oil and meal. The dominant forms, making up 60-70% of total foreign production were fillets and split salted cod, gutted head off diagonal redfish, gutted head (and tail) off Greenland halibut, gutted head and tail off roundnose grenadier and split salted white hake. Information obtained through interviews suggested that at least 17 countries were market destinations for these products.

In order to produce this diverse set of product forms, 47 models of processing machines were utilized. Each observed vessel had a unique combination of equipment to produce a different mix of products. For any specific product type, yield was generally found to be consistent among machines and well as months and areas. Differences noted among countries were related to variation in the position of head and tail cuts. Product to round weight conversion factors (inverse of yield) were often used to estimate round weight of the kept portions of the catch. Results of experiments on a variety of the products indicated that the values used by the vessels to convert to round weight were often considerably lower than experimentally derived values.

RÉSUMÉ

Kulka, D. W. 1986. Aspects of offshore production of fish products for stocks of the Grand Banks and Labrador shelf. Can. Tech. Rep. Fish. Aquat. Sci. 1481: v + 46 p.

Douze flottilles nationales, y compris celle du Canada, produisent une variété de produits frais, congelés et salés ainsi que de l'huile et de la farine, tirés d'environ 260 000 t de poissons capturés dans les eaux hauturières du Grand banc et de la plate-forme du Labrador. Les chalutiers canadiens de pêche fraîche ayant une capacité minimale de transformation débarquent du poisson entier ou éviscéré. Par contre, les navires-usines étrangers fabriquent 77 produits allant du poisson éviscéré au filet désossé et paré et aux sous-produits du traitement. Chaque type de produit est congelé sous forme de blocs de diverses tailles, entiers ou en couches séparées de cellophane, congelés séparément, mis en sac en vrac (crevette), mis en conserve ou transformé en huile et farine. Les filets, la morue salée fendue, le sébaste étêté et éviscéré, le flétan du Groenland éviscéré, étêté

et équeuté, le grenadier de roche éviscéré, étêté et équeuté et la merluche fendue et salée constituent les principaux produits qui représentent de 60 à 70 % de la production étrangère totale. Selon les données recueillies au cours d'entrevues, au moins 17 pays sont les marchés cibles de ces produits.

On a utilisé 47 modèles de machines de traitement pour fabriquer ces divers produits. Chaque navire observé possédait un ensemble unique d'équipement pour produire un assortiment différent de produits. Pour tout produit donné, le rendement était généralement uniforme entre les machines, les mois et les zones. Les différences relevées entre les pays avaient trait à l'emplacement où l'étêtage et l'équeutage se pratiquaient. Les facteurs de conversion du produit en poids entier (inverse du rendement) ont souvent été utilisés pour déterminer le poids entier des parties gardées de la prise. Les résultats d'expériences menées sur une variété des produits ont révélé que les valeurs de conversion en poids entier utilisées à bord des navires étaient souvent très inférieures aux valeurs obtenues expérimentalement.

INTRODUCTION

International allocations for the Grand Banks and Labrador Shelf inside the 200 mile limit amounted to 130,000 t in 1985 of which 45% was utilized (Table 1). In contrast to the Canadian offshore fleet which landed mainly gutted, bobtailed, and whole fish on ice, the foreign catches were processed on board factory trawlers into a diverse set of packaged products ready for the market. Previously, little information pertaining to the production operations and facilities of the foreign fleets was available to Canada. Over the past five years the opportunity arose to collect such data through the Fisheries Observer Program, Newfoundland Region. Over the past two years interviews with vessel personnel provided detailed information about onboard production including processing procedures, production machinery and product mix as it related to market needs of the various countries using their allocations.

Some information on conversion factors extracted from earlier phases of this study had been summarized in Kulka 1983a, b, and 1986 but these focused only on the specific aspect of product yield. Therefore, more general information on offshore production in Canadian Atlantic waters, Grand Banks, and the Labrador Shelf are presented here in order to enhance current knowledge of the offshore fishery.

METHODS

Product to whole weight conversion factor data were collected according to standard methods (Kulka and Firth 1985). Specific corresponding detailed product descriptions can be found in Kulka (1983c and 1986). Product yield data were collected between 1981 and 1985 and differences among countries, areas, seasons and machines were delineated by the methods in (Kulka 1986). Descriptive data on other aspects of production were compiled by Canadian fishery observers in 165 detailed narrative reports corresponding to 115 factory trawlers. Much of this information pertaining to machinery and processing was obtained by direct observation and measurement, and from production machinery pamplets giving company specifications. Information on product yield (magnitude of conversion factors utilized by the various vessels), production procedures and strategies were obtained through interviews with key vessel personnel. Some of the anecdotal data, particularly market destination information could not be confirmed and therefore cannot be considered as definitive. Because of the very large volume, information on production rates and factory capabilities with respect to daily output for each ship could not be summarized.

RESULTS AND DISCUSSION

Production on factory fishing vessels was found to be a complex operation and aspects such as machinery used or products produced was highly variable among fleets. Table 2 summarizes by machine type and process the brand names and countries using the particular equipment. It is immediately apparent that diversity rather than standardization is the rule. The majority of machines were of the Baader brand and often different combinations of the same models

were used by the various fleets. Numbering codes for the Baader equipment ran in series, depending on the general product type produced. There was considerable variation observed in age and efficiency of these machinery. In most cases, yield for each specific product was found to be similar among machines but corresponding processing rates (fish per/hour) varied widely among individual vessels. Depending mainly on the mix of machine types and their respective ages, crew processing capability, product mix and amount of subprocessing such as trimming, vessel production capabilities were variable. Hence, production information related to machine rates and capacities were not summarized. Theoretical capabilities can however be found in the descriptive portion of the Canadian license for each vessel.

Factory trawlers of the observed foreign fleets produced many specific product forms each with a unique yield. Table 3 lists proportions of the products produced from each species in the 1984 observed fishery and is representative of production for recent years. Output for each fleet was often dominated by two or three product types per species but a wide range of both primary and secondary products, such as gutted, gutted head off, fillets, oil and meal were observed. The dominant forms, making up about 60-70% of the 1984 foreign production output were as follows: cod, fillets of various types (55% of production for this species), split salted (35%); redfish, gutted head off diagonal (88%); Greenland halibut, gutted head (and tail) off (92%); roundnose grenadier, gutted head and tail off (96%); white hake, split (95%). Haddock, pollock and silver hake were frozen whole gutted or head off, wolffish were filleted, put to meal or gutted head off, skate were processed to wings, plaice were gutted head off or frozen and halibut were gutted or gutted head off. Almost all species were utilized in some way. Undersized fish and minor species often went to meal. On the contrary, Canadian vessels "produced" only very primary forms such as gutted, gutted and gilled, and bobtail. Chartered Resource Short Plant Program vessels landed frozen gutted head off diagonal and gutted head off collar bone in cod and redfish to Canadian plants.

Interviews with key vessel personnel on each vessel revealed that a substantial proportion of products were destined for markets other than that of the home country. Table 4 qualitatively summarizes by species and product (excluding Canada's shore based production), the producer and market destination[1]. Markets were diverse and variable but in 1984 the following were the major products in order of production volume, and their destinations:

(1) Capelin, whole - USSR.

(2) Cod, split salted - Brazil, Denmark, France, Italy, Norway, Portugal and Spain.

(3) Cod, skinless fillets - Africa, EEC (Mainly France, and FRG), GDR, Spain, USA, USSR.

[1]Data were anecdotal in nature. Information could not be certified as complete or correct through market records, therefore should not be considered as definitive.

(4) Redfish, gutted head off, diagonal - FRG, GDR, Japan, Poland, Portugal, UK, and USSR.

(5) Greenland halibut, gutted head (and tail) off - Faroes, FRG, GDR, Japan, Norway, Poland, and UK.

(6) Cod, skinless boneless fillets - EEC (including FRG) Switzerland, USA.

(7) Roundnose grenadier, gutted head and tail off - Africa, GDR, Poland, Spain, and USSR.

(8) White hake, split salted - Brazil, Italy, Portugal.

(9) Witch, gutted head off - FRG, Japan, Poland, Portugal, Spain, and UK.

In all, 17 countries plus several nonspecific African and Scandinavian destinations were identified as markets for the 77 products produced from Grand Bank and Labrador Shelf catches.

Table 5 lists all product to whole weight conversion factors derived from in situ experiments conducted over a five year period including portions already summarized in Kulka (1983, 1986). Conversion factors were experimentally derived for forty-one specific products produced in significant quantities and some significant differences in yield were detected among countries as explained in Kulka (1986). For example, small but statistically different yields (pertaining to the effects of differential stomach fullness and gonad size) were observed among ten months of data for split fresh cod. Yield for this product was about 3-4% higher than the average during August, September and October, just after spawning. However, in practical terms the 1.67 yearly average conversion factor for split cod can be utilized throughout the year given the small seasonal difference.

Area fished, and machinery used for cutting the fish were found not to have a significant effect on final yield. Only in the case of peeled shrimp did the machine type (P233 vs. P322) greatly affect yield. New or properly tuned filleting machines were sometimes observed to produce better yields than older, improperly set machines. However, hand trimming of the product after filleting generally neutralized this affect probably because greater trimming was necessary for the high yield fillets to produce an acceptable final product. Also, the actual yield was considerably less than theoretical levels listed in company specifications for said equipment because conditions in the factories at sea tended to depress yield during sea production.

The significant differences in yield detected among countries was related to different positions of head or fillet cuts, or amount of trimming. For example, skin on, bone in cod fillets hand produced by USSR were higher in yield than equivalent machine-produced FRG product because greater care was taken to retain nape flesh during fillet removal and trimming was less extensive. France was also able to produce lower yield skinless trimmed cod fillets than FRG by less extensive post-filleting trimming. USSR was able to obtain better yield than for GDR for gutted head and tail off grenadier by removing less of the tail. For diagonal head off redfish, Japan obtained a

higher yield than other countries by using a less steep cut thus retaining more of the belly flap. In the case of Greenland halibut products, three unique head cuts of the single and double variety resulted in significantly different yields among countries. Cutting and trimming configuration was identified as the single most important factor affecting yield. Substantial changes in these procedures resulted in a different product with unique yield.

Converting fish product weights to whole is commonly used by foreign fleets to derive estimates of weight for the retained portion of catches. Accuracy of results depends on the reliability of product records and use of pertinent conversion factors to obtain whole weight equivalents (Kulka 1983). Table 6 indicates that conversion factors used by the various observed vessels were sometimes not only considerably different from the experimentally derived values but that a multitude of factors often existed for each product. In addition to the STACAC standards (Anon 1984) and NAFO conversion factors (NAFO Secretariat 1984), many vessels used unique conversion factors supplied by the company. In certain cases there were almost as many conversion factors in use for a particular product as there were vessels fishing. Also, company factors were often derived from theoretical yield capabilities of the machinery and did not account for yield reduction due to post-machine treatment or sub-optiumum operation of machinery at sea. Poor product definition and lack of documentation regarding the derivation of used conversion factors also hampered their reliability.

Reliability of product records in terms of stored block weight can also affect the quality of round weight estimates when the product conversion method is used. Commonly, product weight is estimated by keeping a count of the frozen product blocks and multiplying by an average block weight. Therefore, accuracy of these block weight values will bear on the quality of the round weight estimate. Table 7 lists experimentally derived average block weights versus those used by the fleets to estimate weight of various products. The block weights which were used in the calculation of round weights were generally similar to the values estimated by observers. Only for 16% of all observed packaged forms (where sample size was greater than 2), were experimentally derived values greater than 10% different from the value used by the vessel personnel to convert block weights to product weight. In most instances the difference was less than 5%.

A wide variety of packaged forms were observed, presumably to serve diverse markets. In general, finfish were packed in boxes as solid blocks or interleaved product (cellophane layers separating each portion). The latter was used exclusively for fillets. Units sizes varied widely but the most common forms came in 7, 8, 10, 12, 15, 23 and 30 kg blocks depending on product and producing country.

CONCLUSION

Offshore production of fish products in the Canadian Atlantic is a complex operation resulting in wide variety of fresh, frozen and salted forms in addition to meal and oil. Very few consistencies among vessel even within fleets were observed with respect to production equipment layouts, product

types and frozen forms produced, factors used to convert product or block weight estimates, or specified markets. However, in general, relatively few types of machines were used to produce a particular product and they often resulted in similar yields.

Yield was observed to be constant among areas and seasons fished. The product to whole weight conversion factor portion of the study resulted in a set of factors for almost all major product forms excluding meal. These conversion factor data and other information pertaining to products as summarized in this report are intended to provide the background for a better understanding of this aspect of the fishery.

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Table 1. Allocations to foreign countries and reported catches for 1985, Grand Banks to Davis Strait.

Country	Division	Species	Allocation (t)	Reported[a] catch (t)
Cuba	3LN	Redfish	2450	2069
	3O	Redfish	3000	707
Faroes	0	Turbot	3000	895
	2GH	Cod	2500	513
		Turbot	500	32
	2J+3KL	Turbot	500	0
FRG	2GH	Cod	6000	0
	2J+3KL	Cod	7125	7066
France	2GH	Cod	200	0
	2J+3KL	Cod	1545	886
	3LNO	Plaice	625	0
	3NO	Cod	250	0
	3P	Redfish	2000	0
	3Ps	Cod	6400	0
		Plaice	550	0
		Witch	410	0
GDR	0	Turbot	1000	335
	2GH	Cod	500	25
		Turbot	2450	576
	2J+3KL	Turbot	1350	1272
		Witch	400	17
	2+3	Roundnose grenadier	5000	3812
	2+3K	Redfish	750	100
	3LN	Redfish	850	655
Japan	0	Roundnose grenadier	3000	0
	2J+3KL	Turbot	1000	228
	2+3K	Redfish	1250	1238
	3O	Redfish	1250	660
Norway	2GH	Cod	2000	228
	3LNO+4VWX	Porbeagle	500	0
Poland	2GH	Cod	500	0
	2GH	Turbot	500	26
	2J+3KL	Turbot	650	447
	2J+3KL	Witch	1600	554
	2+3	Roundnose grenadier	800	14
	2+3K	Redfish	660	65

. . . 2

Table 1 (Cont'd.)

Country	Stock	Species	Allocation (t)	Reported[a] catch (t)
Portugal	2GH	Cod	1000	0
	2J+3KL	Cod	6700	4230
	2J+3KL	Witch	(800)	1
	2+3K	Redfish	420	66
	3NO	Cod	1315	602
	3NO	White hake	2500	1860
	30	Redfish	2100	0
UK	2GH	Cod	300	0
	2J+3KL	Cod	830	0
USSR	0	Turbot	1000	90
	0	Roundnose grenadier	500	0
	2GH	Turbot	350	15
	2J+3KL	Turbot	500	174
	2J+3KL	Witch	1000	214
	2+3	Roundnose grenadier	4100	1011
	2+3K	Capelin	16775	16637
	2+3K	Redfish	3700	3658
	3LN	Redfish	10900	0
	3NO	Cod	4000	0
	3NO	Witch	1950	0
	30	Redfish	6000	786
Total			137905	51744

[a]Reported catches according to the Flash informaton system includes only directed catches from inside the 200 mile limit. An additional 5,000 t was taken as bycatch.

Table 2. Summary of production machinery on observed factory trawlers fishing within Canada's 200 mile limit.

Machine type	Machine name	Country
Process = gutted head off		
Header medium/large[b]	B58[a]	Portugal
Header	B166	Portugal
Header	B400	Portugal
Header (V cut) large	B412	Poland, GDR, USSR
Header	B413	Poland
Header (round cut) medium/large	B415	Portugal, France
Header (straight cut) large	B424	FRG
Header	Circular saw	Portugal, FRG, Japan, USSR
Header	Bench blade cutter	Japan
Header	KM-60	GDR
Header gutter small/medium	B160	FRG, France
Header gutter medium/large	B161	France
Header gutter large	B419	FRG, France
Header gutter large	B423	FRG
Header gutter	Circular saw	FRG, USSR, Portugal
Process = fillet skinning		
Skinner	B46	France, Poland, GDR
Skinner	B47	France,Poland, USSR GDR, Portugal
Skinner	B48	Poland
Skinner	B49	Poland
Skinner	B51	FRG, France
Skinner Redfish	B55	FRG
Process = splitting		
Splitter medium/large	B440	Portugal, France
Process = filleting		
Header filleter herring/ mackerel 20-40 cm	B33	FRG, France, GDR
Header filleter small/medium	B34	FRG, France
Header filleter, redfish/cod medium/large	B150	FRG, Poland, GDR
Header filleter redfish 17-35 cm	B157	FRG
Header filleter small/medium	B181	FRG, Poland

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Table 2 Cont'd.

Machine type	Machine name	Country
Header filleter herring/mackerel	B334	France
Header filleter	B338	France, GDR
Filleter (small fish)	B38	France
Filleter (large cod)	B99	FRG, Poland, France, GDR USSR
Filleter (small/medium redfish)	B151	FRG
Filleter	B168	USSR
Filleter	B181	FRG, Poland
Filleter (small/medium fish)	B188	Poland, USSR
Filleter (small medium 33-66 cm)	B190	FRG, France
Process = mincing		
Mincer	B494	FRG
Mincer	B514	FRG
Mincer	B694	FRG, France
Mincer	B695	FRG, France
Process = shrimp sorting and heading		
Grading shaker	Kronborg	Faroes, Denmark
Grading shaker	Kronborg 02-243	Faroes
Double shrimp sorter	Kronborg FO 2303	France
Single shrimp sorter	Kronborg	France
Separator	Laitram	Faroes
Cooker	Kronborg	Faroes, Denmark, France
Peeler	Laitram PCA	Faroes

[a]"B" denotes Baader machinery.

[b]Refers to fish size.

Table 3. Proportion of products produced from all species for 1984 observed fisheries.

Country	Process[a]	Percentage
Species = Cod		
Canada	Gutted	98.3
	Gutted and gilled	1.6
	Whole	0.1
Canada (RSPP)[b]	Gutted, head off, diagonal	75.6
	Gutted, head off, collar in	12.6
	Split (salted)	9.8
	Gutted, head off, straight	1.2
	Meal	0.8
Cuba	Fillets, skinless	60.0
	Fillets, skinless, boneless	40.0
Faroes	Split (salted)	100
France	Fillets, skinless	70.2
	Fillets, skinless, boneless, trimmed	22.9
	Fillets, skinless, boneless	6.9
St. Pierre	Gutted	100
FRG	Fillets, skinless, boneless	47.4
	Fillets, skinless	31.0
	Fillets, skinless, boneless, trimmed	14.0
	Fillets, skinless, trimmed	3.4
	V fillet, skinless	1.7
	Gutted, head off, straight	1.0
	Meal	0.9
	Fillet, skin on	0.6
GDR	Fillet, skinless	80.0
	Fillet, skinless, trimmed	20.0
Japan	Gutted, head and tail off	74.0
	Gutted, head off staight[b]	11.9
	Gutted, head off, collar in	10.5
	Fillet, skin on	3.6

. . . Cont'd.

Table 3 (Cont'd.)

Country	Process[a]	Percentage
Norway	Split (salted)	100
Poland	Fillet, skinless, boneless	45.5
	Fillet, skinless	27.7
	Fillet, skinless, boneless, trimmed	22.7
	Gutted, head off, straight[b]	2.7
	Gutted, head off, collar in	1.4
Portugal	Split (salted)	88.5
	Gutted, head off, straight	7.4
	Gutted	2.3
	Gutted, head off, diagonal[b]	1.8
UK	Gutted, head off, straight	100
All countries except Canada	Split (salted)	35.1
	Fillet, skinless, boneless	23.0
	Fillet, skinless	21.2
	Fillet, skinless, boneless, trimmed	8.6
	Gutted, head off (various)	7.4
	Fillet (other)	2.6
	Gutted	1.8
	Meal	0.3
Species = Haddock		
Canada	Gutted	59.8
	Gutted, head off (RSPP)	36.5
	Gutted and gilled	3.2
	Whole	0.5
St. Pierre	Gutted	53.9
	Whole	46.1
Japan	Gutted, head off, straight	14.6
	Gutted, head and tail off	85.4
Portugal	Split	69.4
	Gutted, head off, collar in	15.3
	Gutted, head off, straight	10.7
	Fillet, skinless	4.6

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Table 3 (Cont'd.)

Country	Process[a]	Percentage
All countries except Canada	Gutted	39.4
	Whole	33.7
	Split	14.9
	Gutted, head and tail off	4.6
	Gutted, head off, collar in	3.3
	Fillet, skinless	1.1
Species = Pollock		
Canada	Gutted, head off, straight (RSPP)	84.4
	Gutted	15.2
	Gutted and gilled	0.4
Portugal	Split	85.2
	Gutted, head off, collar in	14.8
Species = White hake		
Canada	Gutted	82.4
	Gutted and gilled	17.7
Japan	Gutted, head and tail off	84.6
	Gutted, head off, straight	9.6
	Fillet, skin on	5.8
Portugal	Split	98.5
	Gutted, head off	1.4
	Fillet, skinless	0.1
All countries except Canada	Split	95.1
	Gutted, head and tail off	3.0
	Gutted, head off	1.7
	Fillet (various)	0.2
Species = Silver hake		
Japan	Whole	95.5
	Gutted, head off, straight	4.5
Species = Roughhead grenadier		
GDR	Gutted, head and tail off	96.3
	Meal	3.6
	Gutted, head off	0.1
Poland	Meal	96.6
	Gutted, head and tail off	3.4

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Table 3 (Cont'd.)

Country	Process[a]	Percentage
All countries except Canada	Gutted, head and tail off	96.4
	Meal	3.5
	Gutted, head off	0.1
Species = Roundnose grenadier		
Canada (RSPP)	Whole	100
GDR	Gutted, head and tail off	63.0
	Meal	34.4
	Gutted, head off	2.5
	Fillet	0.1
Poland	Meal	95.5
	Gutted, head and tail off	4.5
All countries except Canada	Gutted, head and tail off	62.8
	Meal	34.6
	Gutted, head off	2.5
	Fillet	0.1
Species = Spotted wolffish		
Canada	Gutted	100
Canada (RSPP)	Fillet, skin on	82.9
	Gutted, head and tail off	9.5
	Split	7.5
St. Pierre	Gutted	100
FRG	Fillet, skinless	59.4
	Fillet, skin on	12.1
	Fillet, skinless, boneless	10.1
	Meal	10.0
	Gutted, head off, straight	8.4
GDR	Fillet, skinless	57.9
	Gutted, head off, straight	42.1
Japan	Fillet, skin on	50.0
	Gutted, head and tail off	50.0
Poland	Meal	100

. . . Cont'd.

Table 3 (Cont'd.)

Country	Process[a]	Percentage
Portugal	Fillet, skinless	55.2
	Fillet, skinless, boneless	24.1
	Split	20.7
UK	Gutted	100
All countries except Canada	Fillet, skinless	40.9
	Meal	21.9
	Fillet, skinless, boneless	13.9
	Split	10.8
	Gutted, head off	4.5
	Gutted	3.5
	Fillet, skin on	3.0
	Gutted, head and tail off	1.5
Species = Broadhhead wolffish		
Canada	Gutted	100
Canada (RSPP)	Gutted, head and tail off	66.7
	Meal	20.5
	Fillet, skin on	3.8
St. Pierre	Gutted	100
FRG	Meal	100
GDR	Gutted, head off	50
	Meal	50
Japan	Gutted, head and tail off	68.1
	Fillet, skin on	31.9
Poland	Meal	100
All countries except Canada	Meal	70.3
	Gutted, head and tail off	18.0
	Fillet, skin on	8.4
	Gutted, head off	2.7
	Gutted	0.6
Canada	Gutted	100

. . . Cont'd.

Table 3 (Cont'd.)

Country	Process[a]	Percentage
Canada (RSPP)	Fillet, skin on	73.7
	Gutted and gilled	15.8
	Gutted, head and tail off	10.5
GDR	Gutted, head off	92.3
	Fillet, skin on	7.7
Japan	Gutted, head off, straight	55.6
	Gutted, head and tail off	44.4
Norway	Fillet, skin on	100
Portugal	Fillet, skinless	100
All countries except Canada	Fillet, skin on	50
	Gutted, head off, straight	28.3
	Fillet, skinless	15.0
	Gutted, head and tail off	6.7
Species = Redfish		
Canada	Whole	100
Canada (RSPP)	Gutted	67.8
	Gutted, head off, diagonal	28.8
	Meal	3.4
Cuba	Gutted, head off, diagonal	98.2
	Meal	1.8
France	Fillet, skin on	85.7
	Meal	14.3
FRG	Fillet, skinless	51.6
	Gutted, head off, diagonal	17.3
	Fillet, skinless, boneless	16.9
	Meal	13.8
	Fillet, skin on	0.4
GDR	Gutted, head off, diagonal	93.7
	Fillet, skinless	5.1
	Gutted, head and tail off	0.7
	Gutted, head off, straight	0.5

. . . Cont'd.

Table 3 (Cont'd.)

Country	Process[a]	Percentage
Japan	Gutted, head off, diagonal	97.2
	Fillet, skin on, boneless	2.7
	Whole	0.1
Poland	Gutted, head off, diagonal	52.9
	Fillet, skinless	18.5
	Fillet, skinless, boneless, trimmed	16.0
	Meal	8.5
	Gutted, head off, straight	2.7
	Fillet, skinless, boneless	0.9
	Fillet, skinless, trimmed	0.5
Portugal	Gutted, head off, diagonal	74.8
	Gutted, head off, straight	24.4
	Fillet, skinless	0.8
Poland	Gutted, head off, diagonal	100
All countries except Canada	Gutted, head off, diagonal	88.3
	Fillet, skinless	4.7
	Fillet, skinless, boneless, trimmed	1.9
	Gutted, head off, straight	1.8
	Meal	1.4
	Fillet, skin on, boneless	1.3
	Gutted, head and tail off	0.2
	Fillet, skin on	0.1
	Fillet, skinless, boneless	0.1
	Fillet, skinless, trimmed	0.1
	Whole	0.1
Species = Plaice		
Canada	Gutted	50.3
	Bobtailed	36.5
	Whole	13.0
	Meal[b]	0.2
France	Meal	100
St. Pierre	Whole	100

. . . Cont'd.

Table 3 (Cont'd.)

Country	Process[a]	Percentage
FRG	Meal	52.4
	Gutted, head off	45.2
	Fillet, skinless	2.4
GDR	Gutted, head off	89.5
	Meal	10.5
Japan	Gutted, head off	54.7
	Whole	42.2
	Gutted, head and tail off	3.1
Poland	Gutted, head off	99.3
	Meal	0.7
Portugal	Gutted, head off	94.1
	Gutted	5.4
	Gutted, head and tail off	0.5
USSR	Gutted, head and tail off	52.9
	Meal	47.1
All countries except Canada	Gutted, head off	61.0
	Whole	30.2
	Meal	5.3
	Gutted	2.8
	Gutted, head and tail off	0.6
	Fillet, skinless	0.1
Species = Yellowtail		
Canada	Bobtail	64.0
	Gutted	21.6
	Whole	14.4
St. Pierre	Whole	100
Species = Witch		
Canada	Whole	54.5
	Bobtail	42.2
	Gutted	3.3
FRG	Meal	100

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Table 3 (Cont'd.)

Country	Process[a]	Percentage
GDR	Gutted, head off	98.8
	Fillet, skinless	0.9
	Gutted, head and tail off	0.3
Japan	Whole	82.9
	Gutted, head off	14.2
	Gutted, head and tail off	2.9
Poland	Gutted, head off	100
Portugal	Gutted, head off	100
All countries except Canada	Gutted, head off	97.7
	Whole	2.0
	Gutted, head and tail off	0.1
	Fillet, skinless	0.1
	Meal	0.1
Species = Greenland halibut		
Canada	Gutted	79.5
	Bobtail	20.2
	Gutted and gilled	0.2
	Whole	0.1
Canada (RSPP)	Gutted, head off	74.7
	Meal	14.7
	Fillet	10.7
Faroes	Gutted, head off	100
FRG	Fillet	75.0
	Gutted, head off	25.0
GDR	Gutted, head off	94.8
	Fillet, skinless trimmed	5.0
	Gutted	0.1
	Gutted, head and tail off	0.1
Japan	Gutted, head and tail off	98.5
	Fillet	0.9
	Gutted, head off	0.5
	Whole	0.1

. . . Cont'd.

Table 3 (Cont'd.)

Country	Process[a]	Percentage
Norway	Gutted, head off	87.5
	Gutted, head and tail off	12.5
Poland	Gutted, head off	73.0
	Fillet, skinless trimmed	26.7
	Topside fillet	0.1
	Meal	0.1
	Gutted	0.1
Portugal	Gutted, head off	79.2
	Gutted, head and tail off	20.8
USSR	Gutted, head off	100
All countries except Canada	Gutted, head off	71.2
	Gutted, head and tail off	21.0
	Fillet, skinless trimmed	7.2
	Fillet	0.3
	Whole	0.1
	Topside fillet	0.1
	Meal	0.1
Species = Halibut		
Canada	Gutted	81.4
	Whole	9.3
	Gutted and gilled	9.3
Canada (RSPP)	Gutted, head off	96.9
	Meal	3.1
Faroes	Gutted, head off	100
France	Gutted, head off	100
FRG	Gutted, head off	100
GDR	Gutted head off	98.4
	Skinless fillet	1.6

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Table 3 (Cont'd.)

Country	Process[a]	Percentage
Japan	Gutted, head and tail off	54.8
	Fillet	30.1
	Gutted	14.0
	Gutted, head off	1.1
Norway	Gutted, head off	100
Poland	Fillet	91.3
	Gutted, head off	8.7
Portugal	Gutted	50.4
	Gutted, head off	43.8
	Fillet, skinless	5.8
USSR	Gutted	100
All countries except Canada	Gutted, head off	39.3
	Gutted	30.0
	Fillet	14.0
	Gutted, head and tail off	12.0
	Fillet, skinless	4.7
Species = Capelin		
USSR	Whole	76.0
	Oil and meal	24.0
Species = Skate		
Canada (RSPP)	Wings	96.5
	Meal	3.5
Cuba	Wings	100
France	Wings	100
St. Pierre	Wings	100
FRG	Meal	100
GDR	Wings	100
Poland	Meal	97.0
	Wings	3.0

. . . Cont'd.

Table 3 (Cont'd.)

Country	Process[a]	Percentage
Portugal	Wings	100
All countries except Canada	Wings	82.9
	Meal	17.1
Species = Blue hake		
GDR	Gutted, head off	90.0
	Gutted, head and tail off	5.8
	Meal	3.7
	Fillet	0.5
Species = Black herring	Gutted, head off	93.8
	Meal	6.2
Species = Shrimp	Cooked frozen	75.4
	Raw frozen	15.6
	Peeled frozen	7.0
	Meal	2.0

[a]Detailed descriptions of processing and subprocessing can be found in Kulka (1983a) and Kulka (1985).

[b]Resource Short Plant Program - vessels chartered to land fish products at Canadian ports.

Table 4[a] Selected reported markets for products produced on factory trawlers in the Northwest Atlantic, Grand Banks to Davis Strait, 1984-85.

Product	Producer[b]	Market
Species = Cod		
Gutted, head off[c] various head cuts	FRG	FRG
	GDR	GDR
	Japan	Japan
	Poland	Poland
	Portugal	Portugal
	UK	UK
	USSR	USSR
Gutted, head and tail off various head cuts	GDR[d]	GDR
	Japan	Japan
	USSR	USSR
Split frozen	Portugal	Portugal
Split salted	Faroes	Denmark, France, Italy, Portugal, Spain
	Norway	Norway
	Portugal	Brazil, Italy, Portugal
Split fish by-products, faces, tongues, sound bones	Portugal	Brazil, Italy, Portugal
Fillets, skin on, bone in[e]	FRG	FRG
	Japan	Spain
Fillets, skinless, bone in	France	France
	FRG	EEC, USA
	GDR	Africa, FRG, GDR, Spain
	Poland	USA
	USSR	USSR

. . . Cont'd.

Table 4 (Cont'd.)

Product	Producer	Market
Fillets, skinless, bone in, trimmed	FRG GDR	USA Africa, FRG, GDR, Spain
Fillets, skinless, boneless	France FRG Poland	EEC EEC, FRG, Switzerland, USA, USA
Fillets, skinless, boneless, trimmed	France FRG Poland	France UK Poland, USA
V-fillet, skinless	FRG	USA
V-fillet, skinless, trimmed	FRG	USA
Mince (fillet by-product)	France FRG	France FRG
Roe	Japan	Japan
Livers	USSR	USSR
Species = White hake Gutted, head off	Portugal	Portugal
Gutted, head and tail off, straight cut	Japan	Japan
Gutted, head and tail off, diagonal cut	Japan	Spain
Split, frozen	Portugal	Portugal
Split, salted	Portugal	Brazil, Italy, Portugal

. . . Cont'd.

Table 4 (Cont'd.)

Product	Producer	Market
Split fish by-products	Portugal	Portugal
Fillets, skin on, bone in	Japan	Spain
Species = Haddock		
Gutted, head off	Portugal	Portugal
Gutted, head and tail off	Japan	Spain
Split, salted	Portugal	Brazil, Italy, Portugal
Fillet, skin on, bone in	Portugal	Brazil, Italy, Portugal
Fillet, skinless, bone in	Portugal	Brazil, Italy, Portugal
Species = Pollock		
Gutted, head off	Portugal	Portugal
Split, salted	Portugal	Portugal
Gutted, head off	Portugal	Portugal
Split, salted	Portugal	Brazil, Italy
Species = Silver hake		
Gutted, head off, straight cut	Japan	Japan (large) Spain (small)
	Portugal	Portugal
Species = Roundnose grenadier		
Gutted, head off	Poland	FRG UK
	GDR	GDR
Gutted, head and tail off	Poland	Poland
	GDR	Africa, Spain, GDR
	Portugal	Japan
Fillet, skinless	GDR	GDR

. . . Cont'd.

Table 4 (Cont'd.)

Product	Producer	Market
Species = Argentine		
Gutted, head off, straight cut	Japan	Japan
Species = Spotted wolffish		
Gutted	UK	UK
Gutted, head off	FRG	FRG
	Norway	Norway
	GDR	GDR
	FRG	FRG
Gutted, head and tail off	Japan	Spain
Fillet, skin on, bone in	FRG	FRG
	Japan	Spain
	Norway	Norway
	GDR	GDR
	Portugal	Portugal
	Poland	Poland
Species = Striped wolffish		
Gutted, head off	Japan	Japan
	GDR	GDR
Gutted, head and tail off	Japan	Japan, Spain
Fillet, skin on, bone in	Japan	Spain
	GDR	GDR
Species = Northern wolffish		
Gutted, head and tail off	Japan	Japan, Spain
Fillets, skin on, bone in	Japan	Spain
Species = Blue hake		
Gutted, head off	GDR	GDR
Species = Black herring		
Gutted, head off	GDR	GDR

. . . Cont'd.

Table 4 (Cont'd.)

Product	Producer	Market
Species = Witch (Cont'd)		
Gutted, head off	Portugal	Portugal
	FRG	FRG
Gutted, head and tail off	Japan	Japan
Fillet	Poland	FRG
Species = Greenland halibut		
Gutted, head off	FRG	FRG
	Faroes	Faroes
	Poland	FRG, Poland, UK
	Japan	Japan
	Norway	Norway
	GDR	GDR
Gutted, head and tail off	Japan	Japan
	GDR	GDR
	Faroes	Faroes
Fillets, skinless	Poland	FRG
		Scandinavia
		Poland
	Japan	Japan
	GDR	GDR
Roe	Japan	Japan
Belly strips	GDR	GDR
Species = Halibut		
Gutted	France	W. Europe
	Japan	Japan
Gutted, head off	FRG	FRG
	Faroes	Faroes
	Norway	Norway
	France	France
	Poland	Poland
Gutted, head and tail off	Japan	Japan

. . . Cont'd.

Table 4 (Cont'd.)

Product	Producer	Market
Fillet, skinless	Poland	Poland
	Japan	Japan
Species = Skate		
Wings	France	France
		W. Europe
	Poland	Poland
Species = Monkfish		
Gutted	Portugal	Portugal
Gutted, head and tail off	Japan	Spain
	Portugal	Portugal
Species = Capelin		
Round	USSR	Cuba, GDR, USSR
Species = Greenland shark		
Fillet (chunks)	GDR	GDR
Species = Shrimp		
Whole	France	Japan
		W. Europe
	Faroes	Japan
	Denmark	Japan
Whole, cooked	France	W. Eurpope
	Faroes	W. Europe
	Denmark	Japan
Peeled	Faroes	W. Europe

[a]Data were anecdotal, obtained through interviews with vessel captains. Information could not be verified as complete and correct.

[b]Refers to the country that catches and processes the fish.

[c]This product category consists of a variety of subproducts illustrated in Kulka (1986).

[d]Japan uses both a diagonal and a straight cut to remove the head while GDR uses a straight cut.

[e]Refer to diagrams in Kulka (1983, 1986) for head and fillet cuts.

Table 5[a]. Experimentally derived product to whole weight conversion factors.

Product	Country	Sample size	Conversion factor (yield)	Coefficient of variation
Species = Cod				
Gutted	All	132	1.22 (82)	4.14
Gutted and gilled	All	11	1.24 (81)	1.97
Gutted, head off, collar bone in	All	56	1.56 (64)	4.50
Gutted, head off, straight, collar bone out	All	29	1.69 (59)	6.35
Gutted, head off, diagonal	All	41	1.91 (52)	5.44
Split, fresh	All	443	1.67 (60)	5.50
Fillet, skin on, bone in	FRG	68	2.92 (34)	4.94
	USSR	8	2.74 (37)	4.60
Fillet, skinless	All	154	3.20 (31)	6.18
Fillet, skinless, trimmed	France	13	3.59 (28)	10.98
	FRG	88	3.32 (30)	5.88
Fillet, skin on, boneless	GDR	4	3.40 (29)	4.59
Fillet, skinless, boneless	All	32	3.65 (27)	9.11
Fillet, skinless, boneless, trimmed	All	8	3.88 (26)	3.97
V fillet, skinless	FRG	5	3.67 (27)	8.72
Species = White hake				
Gutted, head off, collar bone in	Portugal	12	1.49 (67)	4.09
Gutted, head off, straight, collar bone out	Portugal	5	1.86 (54)	3.54

. . . Cont'd.

Table 5 (Cont'd.)

Product	Country	Sample size	Conversion factor (yield)	Coefficient of variation
Split	Portugal	21	1.58 (63)	7.05
Species = Roundnose grenadier Gutted, head and tail off	GDR	91	2.52 (40)	7.46
	USSR	87	2.41 (42)	8.93
Species = Redfish Gutted	USSR	15	1.16 (86)	1.47
Gutted and gilled	USSR	7	1.20 (83)	2.60
Gutted, head off, collar bone in	USSR	10	1.52 (66)	2.32
Gutted, head off, straight	All	13	1.88 (53)	7.31
Gutted, head off, diagonal	Japan	28	1.84 (54)	7.11
	Other	39	2.10 (48)	6.69
Fillet, skinless	FRG	4	4.32 (23)	4.50
Species = Plaice Gutted	All	10	1.13 (89)	2.89
Species = Witch Gutted, head off	All	80	1.25 (80)	5.64
Species = Greenland halibut Gutted	All	83	1.09 (92)	2.40
Gutted, head off, single cut	Poland	109	1.46 (69)	5.43
Gutted, head off, double cut	GDR	13	1.58 (63)	5.40
Chunked (steaks)	GDR	8	1.62 (62)	4.33
Gutted, head and tail off, Single cut	Japan	19	1.49 (67)	6.25
	Faroes	40	1.58 (63)	4.76
Double cut	GDR	5	1.94 (52)	12.52

. . . Cont'd.

Table 5 (Cont'd.)

Product	Country	Sample size	Conversion factor (yield)	Coefficient of variation
Fillet	Poland	35	2.42 (41)	5.04
Fillet, skinless, trimmed	All	74	2.96 (34)	6.41
Topside fillet, skin on	USSR	51	5.50 (18)	7.45
Heads	USSR	44	3.22 (31)	7.12
Bodies	USSR	59	2.44 (41)	10.75
Species = Porbeagle				
Gutted, head and tail off, fins trimmed	Faroes	33	1.47 (68)	3.02
Species = Shrimp				
Cooked, whole, frozen	Canada	4	1.0 (1)	-
Head off, in shell	France	5	1.77 (57)	6.29
Peeled				
P232	Denmark	37	4.64 (22)	18.21
P323	Faroes	30	5.60 (18)	16.89
Species = Squid				
Tubed	France	6	2.10 (48)	4.21

[a]Portions of the analyses producing these data are presented in Kulka (1983, 1986). Exact descriptions of product forms can be found in these papers.

Table 6. Conversion factors used by various countries to derive round from product weight.

Product form	Country	Ship conversion factors	Derived[a] conversion factors
Species = Cod			
Gutted	Portugal	1.20	1.22 (2.4)
Gutted, head off, unspecified	FRG	1.71	
	Poland	1.78, 1.82, 1.89	
	Portugal	1.40, 1.50, 1.60	
	UK	1.70, 1.40	
Gutted, head off, straight cut, collar out	Japan	1.70	1.69 (+0.6)
	Portugal	1.50, 1.55, 1.68	1.69 (6.7)
Gutted, head off, diagonal cut, collar out	Japan	1.70	1.91 (10.5)
	Portugal	1.60	1.91 (16.2)
Split, fresh	Faroes	1.70	1.67 (+1.8)
	Portugal	1.20, 1.50, 1.60 1.65, 1.66, 1.67 1.70, 1.80, 1.90	1.67 (2.3)
Split, salted	Faroes	2.30	
	Norway	2.32, 2.34	
	Portugal	2.30, 2.33, 2.35 2.40, 2.50, 2.6, 2.8	
Fillet, skin on, bone in	Japan	2.00	2.92 (31.5)
	FRG	2.90, 3.0	2.92 (1.0)
Fillet, skinless[b], bone in	France	3.20	3.2 (0)
	FRG	3.20	3.2 (0)
	Poland	3.30	3.2 (+3.1)
Fillet, skinless, trimmed	FRG	3.20	3.32 (3.6)
	Poland	3.33	
Fillet, skinless, boneless	France	3.70	3.7 (0)
	FRG	3.70	3.7 (0)
	Poland	3.33, 3.70	3.7 (5)

. . . Cont'd.

Table 6 (Cont'd.)

Product form	Country	Ship conversion factors	Derived[a] conversion factors
Fillet, skinless, boneless, trimmed	France	3.70	3.88 (4.6)
	FRG	3.70	3.88 (4.6)
	Poland	4.00	3.88 (+3.1)
V fillet, skinless	FRG	3.70	3.67 (+0.8)
V fillet, skinless, trimmed	FRG	3.70	
Species = Haddock			
Gutted, head off	Portugal	1.50	
Gutted, head off, diagonal	Japan	1.62, 1.67	
Split, fresh	Portugal	1.50, 1.53, 1.80	
Split, salted	Portugal	3.00	
Fillet, skin on	Portugal	2.50	
Fillets, skinless	Portugal	3.60	
Species = Pollock			
Gutted, head off	Portugal	1.50	
Split, fresh	Portugal	1.53, 1.70	
Species = White hake			
Gutted, head off	Portugal	1.50, 1.60	1.86 (16.7)
Gutted, head off, diagonal	Japan	1.82	
Split, fresh	Portugal	1.50, 1.53, 1.60 1.62, 1.68, 1.70 1.80	1.58 (+3.3)
Split, salted	Portugal	2.34, 2.45, 2.50	
Fillet, skin on	Japan	2.56	

. . . Cont'd.

Table 6 (Cont'd.)

Product form	Country	Ship conversion factors	Derived[a] conversion factors
Species = Silver hake			
Gutted, head off	Portugal	1.50	
Gutted, head off, straight	Japan	1.70	
Species = Red hake	Japan	1.62	
Species = Blue hake			
Gutted, head off	GDR	1.69	
Species = Roundnose grenadier			
Gutted, head and tail off	GDR	2.50	2.52 (0.1)
Gutted, head and tail off	Poland	2.63	2.52 (+5.2)
	Portugal	2.10	2.52 (16.7)
Fillet, skinless	FRG	2.60	
Species = Wolffish (unspecified)			
Gutted	UK	1.20	
Gutted, head off	FRG	1.38, 1.69	
Fillet, skinless	FRG	2.98, 3.29	
	Portugal	3.20, 3.00, 3.30	
Fillet, skinless, trimmed	Portugal	3.20	
Fillet, skinless, boneless	Portugal	4.00	
Fillet, skinless, boneless, trimmed	Portugal	3.50, 4.00	
Species = Spotted wolffish			
Gutted, head off, diagonal	Japan	1.54	
Fillets	Japan	2.50, 2.00	
Species = Striped wolffish			
Gutted, head off, diagonal	Japan	1.70, 1.54	
Fillets	Japan	2.00, 2.50	

. . . Cont'd.

Table 6 (Cont'd.)

Product form	Country	Ship conversion factors	Derived[a] conversion factors
Species = Northern wolffish			
Gutted, head off, diagonal	Japan	1.54, 1.70	
Fillets	Japan	2.00, 2.50	
Species = Redfish			
Gutted, head off	FRG	1.93	
Gutted, head off, straight, collar in	Portugal	1.10, 1.30, 1.50 1.68	1.52 (8.2)
Gutted, head off, diagonal	FRG	1.39, 1.93, 2.0	2.10 (15.6)
	GDR	2.10	2.10 (0)
	Japan	1.70, 1.73, 1.80, 1.82	1.84 (4.3)
	Poland	1.88, 1.89	2.10 (10.2)
	Portugal	1.33, 1.40, 1.65, 1.70, 1.85	2.10 (24.5)
	UK	1.50	2.10 (28.5)
Fillet, skin on	FRG	3.00	
Fillet, skinless	FRG	3.00, 3.20	4.32 (28.2)
	Poland	3.70	4.32 (14.4)
Fillet, skinless, boneless	Poland	3.70	4.32 (14.4)
Species = Atlantic halibut			
Gutted, head off	Faroes	1.20	
	FRG	1.38	
	Japan	1.48, 1.62	
	Portugal	1.30, 1.40	
Fillet, trimmed	Japan	1.92	
Fillet, boneless, trimmed	Poland	2.63	

. . . Cont'd.

Table 6 (Cont'd.)

Product form	Country	Ship conversion factors	Derived[a] conversion factors
Species = Greenland halibut			
Gutted, head off	Faroes	1.20	
	FRG	1.38, 1.39	
	GDR	1.80	1.58 (+13.9)
	Japan	1.43, 1.62, 1.70	
	Norway	1.25	
	Poland	1.32, 1.42, 1.43	
	Portugal	1.20, 1.29, 1.30, 1.40, 1.50, 1.70	
	UK	1.20	
Fillet	Japan	2.50	
Fillet, trimmed	Japan	3.45	
Fillet, skinless	GDR	3.40	
	Poland	2.63	
Fillet, skinless, trimmed	Poland	2.62, 2.63	
Chunks	GDR	2.03	1.62 (+25.2)
Species = Witch			
Gutted, head off	FRG	1.39	1.25 (+11.2)
	Japan	1.62	1.25 (+29.6)
	Poland	1.24, 1.31, 1.32 1.43	1.25 (+6.0)
	Portugal	1.40, 1.50	1.25 (+16.0)
Species = Plaice			
Gutted, head off	Poland	1.42, 1.43	
	Portugal	1.10, 1.25, 1.29 1.30, 1.40, 1.48 1.50, 1.70, 1.80	
	USSR	1.40	
Species = Eelpouts			
Gutted	UK	1.20	

. . . Cont'd.

Table 6 Cont'd.

Product form	Country	Ship conversion factors	Derived[a] conversion factors
Species = Skate			
Wings	France	5.00	
	GDR	3.90	
	Portugal	1.30, 2.45, 2.50 3.0, 2.90, 3.00, 4.00	
Gutted, head off	Portugal	2.40	
Species = Black herring			
Gutted, head off	GDR	1.70	
Species = Monkfish			
Gutted	Portugal	1.50	
Gutted, head off fins trimmed	Japan	3.34	
Fillet	Portugal	5.50	
Species = Argentine			
Gutted, head off, straight cut	Japan	1.24	
Species = Shrimp			
Peeled	Faroes	5.50,	5.6 (1.8)
Head off	France	1.60	1.77 (9.6)

[a]Values in brackets represent the difference between average of ship conversion factors and derived conversion factor, expressed as a percentage. This difference does not account for factors used by unobserved vessels nor does it weight the factors by amount of catch. This value of percent difference is given only as a rough indicator of where inappropriate factors were used.

[b]Skinless and skinless bonless cod fillet factors were set by Canada for EEC countries.

Table 7. Product forms for which block weights were experimentally derived.

Species	Product	Frozen[a] form	$\bar{x}$ Calc.[b] block weight	No. of samples	Coeff. of variation	Used[c] block weight		% [d] Difference
Country=Canada								
Shrimp	Raw	Box	5.3	21	3.1	5	(5-5.3)	6
		Bag	18.9	9	2.3	16		18
	Cooked	Unspec.	15.6	7	4.0	15		4
		Box	5.8	15	2.1	5		16
Country=Denmark								
Shrimp	Raw 70-90	Box (12x1 kg)	14.2	12	5.5	12		18
	90-120	Box (12x1 kg)	14.3	3	0.4	12		19
	Raw	Box	5.3	6	2.5	5		6
	Cooked 120-170	Box	5.6	3	0.6	5		12
	170-250	Box	5.5	3	1.0	5		10
	Cooked	Box	5.2	25	4.5	5		4
	Cooked, peeled	Bag	10.3	8	1.5	10		3
	Cooked, peeled broken/small	Box	29.3	16	2.9	27		9
Country=Faroes								
Shrimp	Cooked	Box	5.7	36	3.3	5.5	(5-5.8)	4
	Raw 70-90	Box	1.2	3	3.8	1		20
	Cooked 70-90	Box	5.3	7	1.3	5		6
	90-120	Box	5.4	9	2.0	5		8
	120-150	Box	5.5	8	2.9	5		10
	Cooked, peeled	Bag	6.3	2	4.3	6		5

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen[a] form	x̄ Calc.[b] block weight	No. of samples	Coeff. of variation	Used[c] block weight	% difference[d]
Country=FRG							
Cod	Skinless fillet	Interleaf block	6.7	5	9.6	7 (6.6-7.5)	4
		"	8.4	6	1.5	8.5 (8.4-8.5)	1
		"	10.0	9	3.3	10 (9.5-10)	0
		"	26.2	1		26	1
	Skinless fillet	Solid block	7.2	3	3.3	7.5 (7-7.6)	4
		"	8.4	17	3.0	8.5 (8-8.5)	1
		"	23.7	4	3.4	23.5 (23-24)	1
		"	26.1	4	2.5	26 (25.5-26)	1
	Skinless boneless fillet	Interleaf block	7.7	1		7.5	2
		"	8.5	14	2.4	8.5 (8-8.8)	1
		"	10.3	2	0.8	10	3
	Skinless boneless fillet	Solid block	8.8	10	2.6	8.5 (8.4-9)	3
		"	10.1	3	0.6	10	1
		"	11.6	10	2.9	11.5 (11.2-11.5)	0
		"	26.3	12	1.5	26 (25.5-26.6)	1
	Gutted head off	Solid block	8.6	2	1.4	9	4
	Minced trimmings	Solid block	10.1	1		10	1
		"	26.1	4	1.4	26 (25.5-26)	0
Plaice	Gutted head off	Solid block	21.8	1		22	1
Redfish	Skinless fillet	Solid block	7.6	2	1.5	7.5	2
		"	11.2	3	0.9	11.5	3

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen[a] form	% Calc.[b] block weight	No. of samples	Coeff. of variation	Used[c] block weight		% [d] difference
Country=France								
Cod	Skinless fillet	Interleaf block	7.8	3	2.6	7.5		4
		"	11.8	8	5.4	11.5	(11-12)	3
		"	29.7	3	0.7	29		2
		Solid block	7.5	1		7.5		0
		"	10.5	5	6.0	10.5		0
		"	25.0	1		24		4
		"	30.3	10	4.2	29	(28-30)	4
		"	40.8	3	0.6	40		2
	Skinless boneless fillet	Interleaf block	7.6	5	2.0	7.5		1
		"	12.0	9	5.7	11.5	(11-12)	4
		Solid block	11.8	16	6.4	11.5	(10-12.5)	3
		"	24.0	6	8.8	23	(22-24)	4
		"	29.1	36	2.4	29	(28-30)	0
		"	42.0	1		40		5
	Minced trimmings	Solid block	12.6	1		12.5		1
Redfish	Whole round	Solid block	22.0	2	7.7	25		12
Pollock	Skinless, boneless fillet	Solid block	28.0	1		28		0
Skate	Wings	Solid block	10.6	1		10		6

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen[a] form	$\bar{x}$ Calc.[b] block weight	No. of samples	Coeff. of variation	Used[c] block weight		%[d] difference
Country=France								
Squid	Tubed	Solid block	13.4	6	3.5	12		12
Shrimp	Raw 70-90	Box	0.6	2	4.2	0.5		20
	120-150	Box	8.0	1		7		14
	Cooked 90-120	Box	1.1	2	3.1	1		10
		Box	8.5	1		7.5		13
	120-150	Box	8.5	2	0	7.5		13
	120-180	Box	8.5	1		7.5		13
Various species	Meal	Bag	47.8	1		48		0
Country=GDR								
Roundnose grenadier	Gutted head off tail off	Solid block	8.0	6	5.2	8		0
		"	12.1	18	4.3	12	(11.5-12.5)	1
		"	23.5	22	9.2	22	(21-23)	7
Redfish	Gutted head off	Solid block	8.1	2	1.7	8		1
		"	11.9	7	5.8	12	(11.5-12.5)	1
		"	23.4	13	5.0	23	(22-24)	2
	Skinless, boneless fillet	Solid block	9.9	1		10		1
Greenland halibut	Gutted head off	Solid block	8.2	1		8		3
		"	11.7	2	2.4	11.5		2
		"	21.4	15	6.9	21.5	(19-24)	0
	Chunks	Solid block	22.7	13	6.8	22.5	(21-24)	1

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen[a] form	$\bar{x}$ Calc.[b] block weight	No. of samples	Coeff. of variation	Used[c] block weight	% [d] difference
Country=GDR							
Greenland halibut	Fillet	Solid block	23.9	3	1.7	23	4
	Skinless fillet	Solid block	22.5	7	1.4	22.5 (22-23)	0
	Skinless boneless fillet	Solid block	9.4	3	1.1	9	4
		"	28.3	1		28	1
Cod	Gutted head off	Solid block	22.3	4	2.8	23	3
	Skinless boneless fillet	Solid block	9.7	5	1.9	10	3
Witch	Gutted head off	Solid block	20.3	1		20.5	1
Skate	Wings	Solid block	8.8	1		9	2
		"	19.2	4	11.9	19.5 (16.5-22.5)	2
Country=Japan							
Redfish	Gutted head off	Solid block	11.5	5	2.7	11 (10.5-11.2)	5
		"	15.2	6	0.8	15	1
		"	18.2	2	0.4	18	1
	Whole round	Solid block	17.4	1		16	9

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen[a] form	$\bar{x}$ Calc.[b] block weight	No. of samples	Coeff. of variation		Used[c] block weight	%[d] difference
Country=Japan								
Cod	Gutted head off	Solid block	12.3	36	5.0	12	(11.5-12.2)	3
		"	26.3	8	5.3	26		1
Greenland halibut	Gutted head off tail off	Solid block	11.4	1		10.5		9
Country=Poland								
Cod	Skinless fillet	Solid block	10.4	2	1.7	10		4
	Skinless boneless fillett	Solid block	7.5	7	2.4	7.5		0
		"	10.3	2	0.1	9.5	(9-10)	8
		"	33.2	1		30		11
Greenland halibut	Gutted head off	Solid block	10.0	30	8.9	9.5	(9-10)	5
	Skinless fillet	Solid block	10.3	3	1.2	10		3
	Skinless boneless fillet	Solid block	7.6	7	1.5	7.5		1
		"	10.2	3	2.5	9.5	(9-10)	7
Witch	Gutted head off	Solid block	9.5	49	3.9	9.5	(9-10)	0

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen[a] form	$\bar{x}$ Calc.[b] block weight	No. of samples	Coeff. of variation	Used[c] block weight		% [d] difference
Country=Poland								
Redfish	Gutted head off	Solid block	9.9	10	3.6	9.5	(9-10)	4
		"	31.8	1		27		18
	Skinless boneless fillet	Solid block	10.6	1		10		6
		"	31.6	1		30		5
Plaice	Gutted head off	Solid block	9.6	2	5.0	9.5	(9-10)	1
Roundnose grenadier	Gutted head off tails off	Solid block	8.4	1		9		7
Country=Portugal								
Cod	Gutted head off	Solid block	13.0	17	4.4	12.5	(12-13)	4
		"	20.0	32	8.1	20	(18-22)	0
		"	26.8	10	1.8	26.5	(26-27)	1
		"	40.4	6	7.3	35		15
	Split	Solid block	24.9	9	8.8	22.5	(21-24)	11
		"	27.1	10	2.4	27		0
		"	30.2	4	2.9	30		1
	Faces	Solid block	13	1		13.5		4
	Soundbones	Solid block	14.5	1		14.5		0
White hake	Gutted head off	Solid block	31.7	3	3.6	28		13
	Split	Solid block	30.3	3	2.2	30		1

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen[a] form	$\bar{x}$ Calc.[b] block weight	No. of samples	Coeff. of variation	Used[c] block weight		% difference
Country=Portugal								
Redfish	Gutted head off	Solid block	14.6	11	3.8	14	(13-15)	4
		"	20.5	1		20		3
		"	25.7	2	5.0	25	(24-26)	3
Turbot	Gutted head off	Solid block	22.4	2	7.3	20		12
	Skinless fillet	Solid block	15.5	2	4.6	15.5		0
Plaice	Gutted head off	Solid block	12.7	2	9.5	12	(11-13)	6
		"	24.4	3	5.4	22	(20-24)	11
		"	30.0	1		28		7
	Whole round	Solid block	13.2	1		13		2
Atlantic halibut	Gutted	Solid block	48.0	1		47.5		1
Skate	Wings	Solid block	28.1	1		27		4
Country=USSR								
Capelin	Whole round	Solid block	10.7	79	4.0	10.5	(10-11)	2
Roundnose grenadier	Gutted head off tail off	Solid block	10.5	50	5.6	10.5	(10-11)	0
		"	34.5	6	0	33		5
Redfish	Whole round	Solid block	10.4	3	1.6	10		4

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen block form	1^a $\bar{x}$ Calc.^{b} block weight	No. of samples	Coeff. of variation	Used^c block weight	% Difference^d
Country=USSR							
Redfish	Gutted gilled	Solid block	9.3	2	0.8	9	3
	Gutted	Solid block	10.6	10	2.0	10.5 (10-11)	1
	Gutted head off	Solid block	10.8	13	5.7	10.5 (10-11)	3
	Fillet	Solid block	10.1	8	0.5	10	1
Cod	Gutted	Solid block	30.1	2	0.5	30	0
	Boneless fillet	Solid block	30.2	2	0.9	30	1
Witch	Gutted head off tail off	Solid block	10.1	2	0.2	10	1
Greenland halibut	Whole round	Solid block	10.4	2	0.4	10	4
	Heads	Solid block	9.9	11	7.2	9.5 (9-10)	4
		"	31.6	4	1.3	30	5
	Bodies	Solid block	9.7	24	6.1	10 (9-10)	3
	Gutted	Solid block	10.3	3	0.1	10	3
	Gutted head off	Solid block	10.0	1		10	0

. . . Cont'd.

Table 7 (Cont'd.)

Species	Product	Frozen[a] form	$\bar{x}$ Calc.[b] block weight	No. of samples	Coeff. of variation		Used[c] block weight	%[d] Difference
Country=USSR								
Greenland halibut	Gutted head off tail off	Solid block	34.6	3	0.3	33		5
	Fillet	Solid block	11.0	14	6.7	11	(10-12)	0
	Boneless fillet	Solid block	11.1	11	0.1	10.5	(10-11)	6
	Unspecified fillet	Solid block	34.1	3	0.2	30		14
	Liver	Solid block	10.1	1		10		1

[a]Products were frozen for storage in various block forms or individually. Interleaf, also referred to as shatterpack, is product blocks interspersed by layers of cellophane.

[b]Multiples of product blocks (10-15 blocks per experiment) were weighed and mean weights determined.

[c]Different vessels sometimes used slightly different block weights for the same product block size hence the range given in the brackets. The number to the left represents the average used value for block weight (used to calculate product weight in the hold by multiplying number of blocks) to the nearest ½ kilogram.

[d]Percent difference is the difference between experimentally determined mean value and used value of block weight.